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Compact Substation Material Requisition

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1. General Requirements

1.1 General Information

This Material Requisition defines the procurement requirements for three complete prefabricated compact substation packages for the Dehaghan 10 MW Solar PV Power Plant. The document is intended to form a complete tender and purchase basis that can be issued to qualified Vendors for technical and commercial quotation.

Each compact substation package shall collect the 0.8 kV AC output of the associated PV inverters, step up the voltage to 20 kV through the main transformer, and connect to the plant 20 kV collection system. The Vendor shall provide a complete, coordinated and fit-for-purpose package in accordance with this Material Requisition and the attached purchase-package documents.

Parameter	Requirement
Project	Dehaghan 10 MW Solar PV Power Plant
Application	Grid-connected solar PV power plant
Required Quantity	3 complete compact substation packages
Installation	Outdoor; continuous service
System Frequency	50 Hz
MV System Voltage	20 kV
LV System Voltage	0.8 kV
Required Service Life	25 years

1.2 Site Conditions

All equipment shall be designed, rated and, where applicable, derated for the following project design conditions. These values are mandatory tender design inputs.

Parameter	Design Requirement
Design Ambient Temperature Range	-25°C to +60°C
Relative Humidity	95% maximum, non-condensing
Equipment Design Altitude	2000 m above sea level (AMSL)
Solar Radiation	1200 W/m ²
Installation Environment	Outdoor, dusty, sandy and exposed to direct sunlight
Pollution Level	Heavy
Design Wind Speed	34 m/s
Design Snow Depth	200 mm
Seismic Horizontal Acceleration	0.30 g
Seismic Vertical Acceleration	0.15 g

1.3 Scope of Supply

Each Compact Substation Package consists of the following items:

No.	Equipment / System	Quantity per Package
1	Prefabricated compact substation enclosure / housing	1 Unit

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No.	Equipment / System	Quantity per Package
2	24 kV SF6 gas-insulated 3-way RMU	1 Set
3	3300 kVA, 20/0.8 kV power transformer	1 Unit
4	0.8 kV LV switchgear assembly	1 Set
5	0.8/0.4 kV auxiliary transformer	1 Unit
6	UPS system	1 Set
7	Communication and monitoring panel / equipment	1 Set
8	Internal auxiliary, lighting, heating and ventilation system	1 Set
9	Internal earthing and bonding system	1 Set

For all three Compact Substation Packages, mandatory spare parts and special tools shall be supplied by the Vendor.

The package scope shall also include the following, whether or not each item is individually identified in the above table:

- Complete internal integration and interconnection of the RMU, transformer, LV switchgear, auxiliary system, UPS, communication/monitoring equipment and enclosure.
- Internal MV connection between the RMU transformer feeder and the transformer HV terminals, including cable, terminations, supports and earthing accessories.
- Internal busbars, power wiring, control wiring, communication wiring, terminal blocks, gland plates, cable supports, cleats, clamps and sealing materials.
- Internal lighting, socket outlets, heaters, ventilation equipment, temperature/humidity control devices and all required internal auxiliary services.
- Current transformers, voltage transformers, meters, protection, indication, control, surge protection and communication devices required by the attached SLD and Technical Specification.
- Internal earthing and bonding, equipment earth bars, door bonding and external earthing connection points.
- Nameplates, labels, warning signs, mimic diagrams, operating instructions and equipment identification.
- Routine tests, FAT, applicable type-test evidence, inspection documents, packing, preservation, handling/storage instructions, O&M manuals and final as-built documentation.
- All mounting hardware, supports, fasteners and accessories required for a complete and operable package.

The Vendor shall be responsible for detailed engineering, equipment selection, coordination, manufacturing, assembly, internal integration, factory testing and documentation of the complete package within the fixed Employer requirements stated in this purchase package.

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1.4 Exclusions

The following items are outside the Vendor scope of this Material Requisition:

- External MV, LV, auxiliary, control and communication cables beyond the terminal points defined in Clause 1.5.
- Civil works, foundations, excavation, trenches, ducts and external cable-support systems.
- External plant earthing grid and external earthing conductors beyond the compact substation earthing interface points.
- Site installation works, external cable laying and external cable termination works.
- Plant-level SCADA hardware and the external plant communication network beyond the defined communication interface points.

1.5 Terminal Points

The package scope boundaries and external interface points are defined as follows:

- MV incoming and outgoing cable termination points at the designated RMU cable compartments.
- 0.8 kV inverter power-cable termination points at the LV switchgear inverter-feeder MCCB terminals.
- External auxiliary, control, alarm and monitoring interfaces at the designated terminal blocks and communication interface panel.
- Fiber-optic interface at the compact substation fiber-optic terminal box / communication panel.
- Earthing interface at the compact substation main earth bar and external earthing pads.
- Mechanical interface at the base frame, fixing points, foundation interface and bottom cable-entry openings.

Inverter monitoring data shall be transferred to the compact substation through Power Line Communication (PLC) over the 0.8 kV inverter power cables; no separate inverter-to-compact data cable is required for this function. The required PLC coupling/interface equipment shall be included in the package.

1.6 Purchase Package Document Index

The documents listed below form one integrated tender / purchase package. The Vendor shall base its technical and commercial offer on the complete package and shall identify any deviation in a formal Deviation List.

No.	Document Title	Document No.	Revision / Status
1	Compact Substation Material Requisition	ATO-D-DEH-E-MR-004	A3 - Issued for Approval
2	Compact Substation Technical Specification	ATO-D-DEH-E-DS-007	A1 - Approved / Attached
3	Compact Substation Single Line Diagram	ATO-D-DEH-E-SL-001	A2 - Attached

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All documents listed above shall be physically included in the tender / purchase package and shall be read together as integral procurement documents. In case of conflict, the order of precedence defined in Clause 2.4 shall apply.

2. Technical Requirements

2.1 Drawings

The following project drawing forms an integral attachment to this Material Requisition and defines the required primary electrical configuration, major ratings, feeder arrangement and package interfaces:

No.	Drawing Title	Document No.	Revision / Status
1	Compact Substation Single Line Diagram	ATO-D-DEH-E-SL-001	A2 - Attached

Vendor detailed drawings, including final general arrangement, detailed SLD, protection/control schematics, wiring diagrams, terminal-block diagrams, cable-entry/termination arrangements, earthing arrangement and communication architecture, shall be submitted in accordance with Clause 2.5.

2.2 Technical Specification

Compact Substation Technical Specification ATO-D-DEH-E-DS-007 Rev. A1 (Approved) is attached to this Material Requisition and forms an integral part of the purchase package. It defines the minimum functional, electrical, mechanical, environmental, constructional, testing and documentation requirements applicable to the compact substation package.

The requirements in this Material Requisition are project-specific procurement requirements. The Vendor shall comply with both documents; any deviation shall be clearly identified in the Vendor Deviation List submitted with the technical offer.

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2.3 Data Sheets

2.3.1 Employer Requirements Data Sheet

The values stated below are mandatory Employer requirements for tendering and equipment design. Where a row is explicitly designated as Vendor Calculated or Vendor Declared, this is an intentional Vendor detailed-design responsibility and shall not be interpreted as missing Employer data. The corresponding calculation or declared value shall be submitted with the technical offer.

Parameter	Employer Requirement
Enclosure	
Type	Prefabricated outdoor compact substation enclosure / housing
Degree of Protection	IP54 for MV, LV, auxiliary/control and accessible electrical compartments
Corrosion Protection	C4 according to ISO 12944 for outdoor PV plant service
Color	RAL 7035
Cable Entry	Bottom entry
Enclosure Dimensions	Vendor Declared; arrangement shall satisfy equipment clearances, maintenance access and transportation constraints
RMU	
Type	SF6 gas-insulated Ring Main Unit
Rated Voltage	24 kV
System Voltage	20 kV
Rated Frequency	50 Hz
Busbar Rated Current	630 A
Short-Time Withstand Current	20 kA for 3 s
Configuration	3-way RMU: two ring switching feeders and one transformer circuit-breaker feeder
Ring Feeder Functions	2 Nos.; 630 A load-break switch / switch-disconnector, each with earthing switch
Transformer Feeder Function	1 No.; 630 A circuit breaker with earthing switch
Voltage Presence Indication	One voltage presence indicator per feeder; 3 sets total
Interlocking	Mechanical/electrical interlocking to prevent unsafe operation between switching devices, earthing switches and cable access
Cable Entry	Bottom cable entry
Transformer Feeder Protection	Self-powered numerical protection relay for phase overcurrent and earth-fault protection; Vendor to state relay manufacturer/model and proposed settings
SF6 Gas Monitoring	Gas pressure or density indication included
Internal Arc Performance	Type-tested in accordance with IEC 62271-200; Vendor to declare IAC classification and submit applicable type-test evidence
Power Transformer	
Type	Two-winding, oil-immersed power transformer

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Parameter	Employer Requirement
Rated Power	3300 kVA continuous at the project design site conditions
Voltage Ratio	20 / 0.8 kV
Rated Frequency	50 Hz
Number of Phases	Three-phase
Vector Group	Dy11
Cooling Method	ONAN
Tap Changer	Off-circuit tap changer
Tap Range	$\pm 2 \times 2.5\%$
Short-Circuit Impedance	7%, tolerance in accordance with IEC 60076
Winding Material	Aluminum / Aluminum
Transformer Oil	New, unused, PCB-free mineral insulating oil in accordance with IEC 60296
Losses	Vendor Declared and guaranteed
Temperature Rise	In accordance with IEC 60076 at the project design site conditions
Accessories	Complete standard accessories, alarms and protection devices in accordance with the attached Technical Specification
LV Switchgear	
Rated Voltage	800 V AC
Rated Frequency	50 Hz
Main Incomer	ACB, 3P
Main ACB Rated Current	3200 A
Main ACB Frame Size	4000 A
Main ACB Breaking Capacity	$I_{cu} = 85 \text{ kA}$; $I_{cs} = 85 \text{ kA}$
Main Busbar Rated Current	3200 A
LV Busbar Short-Circuit Rating	50 kA
Inverter Feeders	$10 \times 400 \text{ A}$, 3P MCCB
Spare Feeder	$1 \times 400 \text{ A}$, 3P MCCB
Power Line Communication Feeder	$1 \times 63 \text{ A}$, 3P MCCB for PLC coupling/interface equipment
Outgoing MCCB Breaking Capacity	$I_{cu} = 50 \text{ kA}$; $I_{cs} = 50 \text{ kA}$
Inverter Cable Termination	Each inverter feeder designed for $3 \times 240 \text{ mm}^2$ aluminum power cable
Metering	Multifunction meter with communication interface
Communication Protocol	Modbus TCP/IP
Surge Protection	Type I+II SPD for the 0.8 kV AC system
Cable Entry	Bottom entry
Phase CTs - CT1	3 Nos.; 3000/1 A; Class 0.2; 15 VA
Additional CT - CT2	1 No.; 3000/1 A; Class 0.5; 10 VA
Voltage Transformers - PT	3 Nos.; $0.8/\sqrt{3}$ / $0.1/\sqrt{3}$ kV; Class 0.2
Auxiliary Power System	
Auxiliary Transformer	Required
Auxiliary Transformer Type	Dry-type, three-phase
Auxiliary Transformer Primary Voltage	0.8 kV

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Parameter	Employer Requirement
Auxiliary Transformer Secondary System	400/230 V AC, three-phase, four-wire; neutral brought out
Auxiliary Transformer Capacity	Vendor Calculated from the complete internal auxiliary load; load calculation and selected rating to be submitted with the technical offer
Auxiliary Transformer Vector Group	Vendor Declared with the technical offer
Auxiliary Transformer Protection	Primary and secondary protection devices included
UPS System	Required
UPS Type	Industrial type suitable for compact substation service
UPS Capacity	Vendor Calculated from the connected critical loads; sizing calculation to be submitted with the technical offer
UPS Backup Time	Vendor Calculated from the required critical-load autonomy; battery autonomy calculation to be submitted with the technical offer
UPS Critical Loads	Communication equipment, monitoring equipment, essential alarm circuits and other critical loads required to maintain monitoring/alarm availability during loss of auxiliary AC supply
UPS Alarms	UPS fault, battery fault, low battery, bypass status and AC input failure
Communication and Monitoring System	
Monitoring Device	Integrated measurement, monitoring, control and communication device
Inverter Data Communication	Power Line Communication (PLC) over 0.8 kV inverter power cables
PLC Coupling / Interface Equipment	Included
Communication Interface	Ethernet / Modbus TCP/IP
Fiber Optic Interface	Single-mode fiber-optic interface included
Network Switch	Included
Fiber Optic Terminal Box	Included
Signal List	Vendor deliverable; complete signal list to be submitted with technical offer / detailed engineering
Communication Architecture	Vendor deliverable; complete architecture and interface drawing to be submitted

2.3.2 Vendor Offered Data Sheet

The Vendor shall complete the following data sheet and submit it with the technical offer. Entries shall correspond to the offered equipment and shall demonstrate compliance with Clause 2.3.1. No blank cells are permitted; where an item is not applicable, the Vendor shall state “N/A” with justification.

Parameter	Vendor Offered
RMU Manufacturer	
RMU Type and Model	

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Parameter	Vendor Offered
RMU Insulation Technology	
RMU Configuration / Functional Arrangement	
RMU Incoming Ring Feeder Function	
RMU Transformer Feeder Function	
RMU Outgoing Ring Feeder Function	
RMU Protection Relay Manufacturer and Model	
RMU Voltage Presence Indicator Type	
RMU Rated Voltage	
RMU Rated Current	
RMU Short-Time Withstand Current and Duration	
RMU Internal Arc Classification	
SF6 Gas Quantity	
SF6 Gas Monitoring Arrangement	
Transformer Manufacturer	
Transformer Rated Power	
Transformer Voltage Ratio	
Transformer Vector Group	
Transformer Short-Circuit Impedance	
Transformer Winding Material	
Transformer No-Load Loss	
Transformer Load Loss	
Transformer Oil Quantity	
Transformer Total Weight	
LV Switchgear Manufacturer	
Main ACB Manufacturer and Model	
Main ACB Rating and Breaking Capacity	
Main ACB Frame Size	
Number of 400 A Inverter Feeders	
Number of 400 A Spare Feeders	
Power Line Communication Feeder Details	
Outgoing MCCB Manufacturer and Model	
Outgoing MCCB Rating and Breaking Capacity	
CT1 Manufacturer, Ratio, Class and Burden	
CT2 Manufacturer, Ratio, Class and Burden	
PT Manufacturer, Ratio, Class and Burden	
Meter Manufacturer and Communication Protocol	
SPD Manufacturer and Rating	
Auxiliary Transformer Manufacturer	

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Parameter	Vendor Offered
Auxiliary Transformer Rated Capacity	
Auxiliary Transformer Voltage Ratio	
Auxiliary Transformer Vector Group	
Auxiliary Transformer Secondary Neutral Arrangement	
Auxiliary Load Calculation Reference	
UPS Manufacturer	
UPS Technology	
UPS Capacity	
UPS Backup Time	
UPS Battery Type	
UPS Load Calculation / Battery Autonomy Calculation Reference	
Communication / Monitoring Equipment Manufacturer	
PLC Coupling / Interface Equipment Manufacturer and Model	
Network Switch Manufacturer	
Fiber Optic Terminal Box Manufacturer	
Enclosure Material	
Enclosure Dimensions	
Total Weight of Complete Compact Substation	
Degree of Protection	
Corrosion Protection System	

2.4 Applicable Standards

The compact substation and all associated equipment shall comply with the latest applicable editions of the IEC and ISO standards specified in the attached Compact Substation Technical Specification.

The principal standards include IEC 62271 series for MV/RMU equipment and prefabricated substations, IEC 60076 series for power transformers, IEC 61439-1/-2 and IEC 60947 series for LV switchgear, IEC 60529 for enclosure protection, IEC 60255 for protection equipment, IEC 61643 series for LV surge protection and ISO 12944 for corrosion protection.

Equivalent international standards may be proposed only when the Vendor demonstrates technical equivalency in the technical offer and identifies the deviation for Purchaser review.

In case of discrepancy between purchase-package documents, the following order of precedence shall apply: (1) Contract / Purchase Order, (2) this Material Requisition, (3) attached Project Single Line Diagram, (4) attached Compact Substation Technical Specification, (5) approved Vendor drawings and documents, and (6) applicable standards and codes. The Vendor shall identify any conflict or ambiguity in the technical offer before proceeding.

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2.5 Documentation Requirements

2.5.1 General

The Vendor shall submit all documents required for technical evaluation, purchase, manufacturing release, inspection, testing, delivery, installation, commissioning, operation and maintenance of the compact substation. Review or approval of Vendor documents by the Purchaser shall not relieve the Vendor from responsibility for correctness, completeness, performance, safety and compliance.

2.5.2 Documents to Be Submitted with Quotation

The Vendor shall submit the following documents with the technical offer:

No.	Document
1	Technical proposal
2	Completed Vendor Offered Data Sheet
3	Compliance statement against this Material Requisition
4	Compliance statement against the Compact Substation Technical Specification
5	Deviation List
6	Preliminary General Arrangement Drawing
7	Preliminary compact substation layout and dimensions
8	Preliminary / Vendor detailed Single Line Diagram
9	RMU datasheet and functional arrangement
10	Transformer datasheet including losses, impedance, oil quantity, dimensions and weight
11	LV switchgear datasheet including ACB/MCCB ratings and short-circuit rating
12	Auxiliary transformer datasheet and preliminary sizing calculation
13	UPS datasheet and preliminary sizing / battery autonomy calculation
14	Communication and monitoring description including PLC architecture
15	List of major components with manufacturer and model
16	Available type-test certificates or reference test reports for major equipment
17	Recommended spare parts list
18	Preliminary delivery, packing, lifting and transportation information

2.5.3 Documents to Be Submitted after Purchase Order

After Purchase Order, the Vendor shall submit the following key engineering and manufacturing documents for Purchaser review before manufacturing release:

No.	Document
1	Final General Arrangement Drawing
2	Final dimensional drawing
3	Foundation and fixing arrangement drawing
4	Lifting and transportation drawing
5	Final Vendor Single Line Diagram

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No.	Document
6	RMU arrangement and datasheet
7	Transformer arrangement and datasheet
8	LV switchgear arrangement and datasheet
9	Protection and control schematic diagrams
10	Wiring and terminal-block diagrams
11	Cable entry and termination arrangement
12	Earthing and bonding arrangement
13	Auxiliary transformer sizing calculation
14	UPS sizing and battery autonomy calculation
15	Communication architecture, PLC interface diagram and signal list
16	Final main component list
17	Inspection and Test Plan
18	Factory Acceptance Test procedure
19	Updated Deviation List, if any

2.5.4 Final Documentation

The final documentation package shall include final approved drawings, final approved datasheets, final test reports, FAT report, applicable certificates of conformity, O&M manuals, installation and commissioning instructions, packing list, spare parts list and final as-built documentation.

3. Procurement, Inspection and Delivery

3.1 Inspection and Testing Requirements

3.1.1 General

The compact substation and all major components shall be inspected and tested in accordance with the attached Technical Specification, applicable IEC standards, approved Vendor documents and the approved Inspection and Test Plan. Detailed type-test, routine-test, functional-test and FAT requirements shall follow the Technical Specification.

3.1.2 Inspection and Test Plan

The Vendor shall submit an Inspection and Test Plan for Purchaser review before manufacturing. The ITP shall identify inspection stages, routine tests, FAT activities, document review points, witness points, hold points where applicable, acceptance criteria, applicable standards and required test reports.

Manufacturing, assembly, testing or shipment shall not proceed beyond an approved hold point without Purchaser clearance.

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3.1.3 Purchaser Inspection and Witnessing

The Purchaser or Purchaser representative shall have the right to witness inspections and tests at the Vendor or manufacturer facility. The Vendor shall provide sufficient advance notice of activities requiring witness. Waiver of witness shall not relieve the Vendor from contractual compliance.

3.1.4 Factory Acceptance Test and Release for Shipment

Factory Acceptance Test shall be performed before shipment in accordance with the approved FAT procedure and Technical Specification. FAT shall verify completeness, correct assembly, internal integration, functional operation, protection, metering, control, communication, auxiliary systems, alarms, interlocking, earthing continuity, marking and compliance with approved documents. Shipment release is subject to completion or formal acceptance of required inspections, tests, documentation checks and punch-list items.

3.1.5 Test Reports and Final Inspection Documents

Final inspection documentation shall include the approved ITP, FAT report, routine test reports, applicable type-test reports/certificates, calibration certificates for FAT instruments, certificates of conformity for major components and non-conformity reports with corrective actions where applicable.

3.1.6 Non-Conformities

Any failed test, non-conformity, missing document, damaged component, incomplete item or deviation from approved documents shall be formally recorded by the Vendor. Corrective actions shall be completed and verified before shipment. No equipment shall be shipped with unresolved critical non-conformities.

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3.2 Spare Parts

3.2.1 General

The Vendor shall include the mandatory spare parts specified below in the base scope of supply for all three compact substation packages. In addition, the Vendor shall submit a priced list of recommended spare parts suitable for two years of normal operation and maintenance. All spare parts shall be new, unused and fully compatible with the supplied equipment.

3.2.2 Mandatory Spare Parts

The following spare parts shall be included in the base scope of supply:

No.	Mandatory Spare Part	Minimum Quantity	Remarks
1	Control circuit fuses, where fused circuits are used	1 complete set	For all supplied compact substations
2	Indicating lamps / LEDs / pilot lights	1 complete set	Applicable to control, alarm, and indication circuits
3	Auxiliary relays	1 complete set	For installed relay types
4	Terminal blocks, terminal markers, wire markers, and connectors	1 complete set	Suitable for supplied terminal block types
5	Door seals and gaskets	1 complete set	For MV, LV, transformer, auxiliary, and control compartments
6	Operating handles, charging handles, and removable operating tools	1 complete set	For RMU, ACB, MCCB, and other applicable devices
7	Interlocking keys and special keys	1 complete set	As applicable to supplied RMU, doors, and interlocking system
8	Ventilation filters, where filters are installed	1 complete set	For all installed filter types
9	Plug-in SPD modules or replacement SPD cartridges, where applicable	1 set per installed SPD type	For LV surge protection devices
10	Spare nameplates, warning labels, and identification tags	1 complete set	For major equipment and feeders

3.2.3 Recommended Spare Parts

The Vendor shall submit a priced recommended spare parts list covering all major equipment and systems supplied under the package, including RMU, transformer, LV switchgear, auxiliary system, UPS, communication/monitoring system, surge protection and enclosure accessories.

No.	Equipment / System	Recommended Spare Parts
1	RMU	Mechanism accessories, auxiliary switches, indication devices, operating mechanism spare parts, gas monitoring device spares, and other manufacturer-recommended RMU spare parts

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No.	Equipment / System	Recommended Spare Parts
2	Transformer	Gaskets, oil level indicator spares, temperature indicator spares, thermometer contacts, protection device spares, silica gel breather, and other manufacturer-recommended transformer spare parts
3	LV Switchgear	ACB/MCCB accessories, auxiliary contacts, shunt trip coils, closing coils, undervoltage releases, electronic trip units, and other manufacturer-recommended LV switchgear spare parts
4	Auxiliary System	MCBs, fuses, auxiliary relays, contactors, power supply units, thermostats, heaters, fans, filters, and control devices
5	UPS System	Batteries, battery fuses, fan modules, control cards, bypass accessories, and other manufacturer-recommended UPS spare parts
6	Communication and Monitoring System	Network switch accessories, communication modules, fiber optic accessories, terminal box accessories, meters, monitoring modules, and power supply units
7	Surge Protection	Replacement SPD modules, cartridges, fuses, disconnectors, and indication contacts
8	Enclosure and Accessories	Locks, hinges, door stoppers, seals, gaskets, filters, labels, and fixing accessories

3.2.4 Spare Parts List Requirements

The spare parts list shall identify each part sufficiently for commercial evaluation, ordering, storage and future replacement.

Item	Required Information
1	Spare part description
2	Manufacturer name
3	Manufacturer part number
4	Applicable equipment and equipment tag
5	Recommended quantity
6	Unit price
7	Lead time
8	Shelf life, where applicable
9	Storage requirements, where applicable
10	Interchangeability with supplied equipment

3.2.5 Spare Parts Availability

The Vendor shall confirm availability of spare parts for at least ten years after delivery. Spare parts with limited shelf life shall be clearly identified with the applicable storage requirements.

3.3 Delivery Time and Location

3.3.1 Delivery time, delivery location, delivery terms, Incoterms, shipment method and commercial delivery conditions shall be defined in the Contract / Purchase Order.

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3.3.2 The Vendor shall submit the proposed manufacturing, inspection, testing, packing and delivery schedule with the technical/commercial offer.

3.3.3 The delivery schedule shall identify planned dates for document submission, document review, manufacturing, factory inspection, FAT, packing, shipment readiness and delivery.

3.3.4 Shipment shall not proceed before completion of required inspections, tests, FAT, documentation review, punch-list close-out and written release for shipment.

3.3.5 The Vendor shall notify the Purchaser in advance of shipment readiness and shall provide the required shipment documents, packing list, lifting/handling instructions, storage instructions and final inspection/test documents before dispatch.

3.3.6 Any delay affecting manufacturing, inspection, FAT, shipment readiness or delivery shall be formally notified together with the reason, recovery plan and revised schedule.

3.4 Product Information, Packaging and Transportation

3.4.1 General

The Vendor shall be responsible for proper packing, preservation, marking, lifting preparation, transportation preparation and delivery documentation for the compact substations and all supplied accessories. Arrangements shall be suitable for the equipment, site conditions, transportation route and handling method.

3.4.2 Equipment Color

Equipment color shall be RAL 7035.

3.4.3 Packing and Preservation

The compact substations and all supplied components shall be packed and preserved to prevent mechanical damage, moisture ingress, corrosion, contamination, dust ingress, loss of accessories and deterioration during transportation, handling, unloading and temporary storage.

Packaging shall be suitable for road and/or sea transportation as applicable.

Sensitive components such as meters, relays, UPS, batteries, communication devices, electronic modules and protection/monitoring devices shall be protected against impact, vibration, humidity, dust and electrostatic damage as applicable.

Loose accessories, spare parts, special tools, operating handles, keys, documents and small components shall be separately packed, clearly labelled and cross-referenced to the packing list.

3.4.4 Package Marking

Each package shall be clearly and durably marked with the information required for identification, handling and delivery control.

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Package marking shall include project name, Vendor name, equipment description, package number, gross and net weight, dimensions, lifting points where applicable, center of gravity where applicable, storage orientation and handling symbols.

Handling/storage symbols shall include, as applicable, fragile, keep dry, this side up, lifting point, center of gravity, sling position and special handling requirements.

3.4.5 Lifting and Handling

The compact substations and major packages shall be provided with suitable lifting points, lifting lugs, base frame, forklift points or equivalent handling facilities for safe loading, unloading, lifting and positioning.

The Vendor shall provide lifting and handling instructions before shipment. Center of gravity and lifting points shall be clearly marked where required. The lifting arrangement shall be suitable for the total equipment weight and dimensions.

3.4.6 Transportation Preparation

Equipment shall be adequately secured for transportation to prevent movement, tilting, impact, vibration damage, deformation, loosening of internal components or damage to enclosure, doors, panels, bushings, ventilation openings and accessories.

Internal components shall be fixed or protected for transportation. Any special transportation limitation, including allowable tilt angle, lifting restriction, stacking restriction, storage limitation or environmental limitation, shall be stated by the Vendor.

3.4.7 Shipping and Delivery Documents

The Vendor shall submit the following shipping and delivery documents before dispatch:

No.	Document
1	Packing list
2	Delivery note
3	Final inspection release note, where applicable
4	FAT report or final test release confirmation
5	Product inspection certificate or certificate of conformity
6	Lifting and handling instructions
7	Storage and preservation instructions
8	Installation and user manual, where applicable for shipment
9	List of loose items, accessories, spare parts, and special tools
10	Shipping marks and package identification list

3.4.8 Receipt at Site

The Vendor shall provide sufficient information to allow proper receipt inspection at site.

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Upon delivery, package identification, visible condition, completeness of accessories, loose items, spare parts and documentation shall be checked against the packing list and delivery documents.

Any visible damage, missing item, packing damage or abnormal indication from shock/tilt indicators shall be recorded and reported in accordance with the Contract or project procedure.